Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band	)	GN Docket No. 12-354
	)	
	)	

COMMENTS OF AT&T

William L. Roughton, Jr.
Michael Goggin
Gary L. Phillips
Lori A. Fink
1120 20th Street, N.W.
Suite 1000
Washington, DC 20036
(202)457-2040
Counsel for AT&T Services, Inc.

July 14, 2014

TABLE OF CONTENTS

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band	)	GN Docket No. 12-354
	)	
	)	
	)	

COMMENTS OF AT&T

I. INTRODUCTION AND SUMMARY

AT&T Services Inc. ("AT&T"), on behalf of the subsidiaries and affiliates of AT&T Inc. (collectively, "AT&T") hereby submits the following comments in response to the Federal Communications Commission's ("Commission") Further Notice of Proposed Rulemaking ("*FNPRM*") in the above-captioned proceeding. In the *FNPRM*, the Commission proposes specific rules for a new Citizens Broadband Radio Service in the 3.5 GHz band. The Citizens Broadband Radio Service is targeted at the deployment of small cell technologies, an advance in radio system design that offers the possibility of vastly higher data rates and throughputs for consumers. AT&T welcomes the opportunity to comment on some of the many complicated technical, legal, and policy issues implicated by the Commission in the *FNPRM*.

As explained below, AT&T applauds the Commission's efforts to make additional spectrum available for commercial uses. The Commission has correctly observed that usage of America's wireless networks is skyrocketing, which dramatically increases demands on both licensed and unlicensed spectrum. In response to this heightened demand for wireless services, carriers are constantly striving to make more efficient use of their spectrum resources, and are turning to innovative new technologies such as small cells and heterogeneous networks. Indeed, while AT&T maintains that the Commission's emphasis should remain on exclusive-use,

licensed spectrum, there may be a complementary role for spectrum sharing as well. The 3.5 GHz band is particularly well-suited for exploring such technologies, and AT&T believes that shared use of this band will help to bolster existing wireless services while helping launch new technologies.

While AT&T commends the Commission for its innovative proposals to allocate the 3.5 GHz band for small cell deployment and spectrum sharing, AT&T is concerned about the complexity of the new and unprecedented Spectrum Access System ("SAS") licensing framework. In particular, given that the SAS structure is the first of its kind, the model will presumably need to undergo extensive testing and refinement prior to deployment, a process that could be time-intensive given the documented technical challenges. To enable this spectrum to be put to use more rapidly and avoid letting spectrum lie fallow, AT&T proposes that the Commission adopt a transitional licensing approach to the 3.5 GHz band.

Key to any successful licensing approach in the 3.5 GHz band will be certainty and transparency for licensees, as well as the adoption of procedures that promote efficient use of spectrum. With these principles in mind, AT&T notes its strong opposition to the Commission's proposal that the SAS make dynamic—as opposed to static—spectrum assignments for Priority Access licenses ("PALs"). In the case of PALs, real-time or near real-time interference management is not practical between PAL users due to stringent interference reporting requirements that will be difficult to be met by the proposed SAS architecture and also due to the disparity of technologies that can be used by PAL users. Very low latency and high bandwidth links between Citizens Broadband Service Devices and a centralized spectrum manager (i.e., the SAS) are required for interference reporting for dynamic spectrum allocation to provide any interference management benefits. Without such high-resolution reporting, a dynamic spectrum

allocation to PAL users that does not respond to the fast-changing interference environment does not provide any spectral efficiency benefits. Moreover, if the SAS were to dynamically allocate geographically adjacent census blocks to operators using the same or different air interface technologies, it is likely that harmful interference and undue degradation of network performance would result.[1] For this reason, AT&T submits that PALs should be assigned specific frequencies within their service area, and their frequency assignment should not be dynamically controlled by the SAS.

AT&T believes that the proposed SAS framework represents admirable progress towards establishing a new Citizens Broadband Radio Service in the 3.5 GHz band. However, substantial work remains if the FCC wants to ensure that the 3.5 GHz spectrum is put to its highest and best use. The Commission will need to engage in testing and proof-of-concept efforts before the SAS framework can be implemented. All three tiers of 3.5 GHz spectrum users must be comfortable with the assumptions made by the SAS and the data contained in the SAS. While the Commission will need to put considerable resources into SAS development, it should not allow this necessary testing to force 3.5 GHz spectrum to remain fallow – the Commission can and should adopt a transitional licensing framework to allow spectrum use while the SAS is in development. During the transition period, the Commission can take steps to prevent and mitigate interference among the various classes of users, including dividing the band between Priority Access and General Access uses during the transition.

The transitional licensing framework proposed by AT&T provides a smooth glide path to the SAS system once it is available. In the interim, the transitional licensing framework should provide spectrum users with the certainty and stability needed to invest and deploy innovative

[1] Even if operators were using the same technology, but with different UL or DL ratios, harmful interference and degraded network performance would likely result.

services. The Commission can help accomplish this by splitting the band into licensed and unlicensed segments, and by providing license terms for PALs that provide certainty to licensees. Licensees should receive a license term of several years to allow time for system development and buildout. These licenses should come with a renewal expectancy, which will further encourage innovation and investment. By adopting reasonable performance requirements for licensees, the Commission can ensure that this framework will lead to efficient and productive spectrum use. At the end of the transitional period, Priority Access licensees can register their frequencies with the SAS, which would then commence management of General Authorized Access utilization of the spectrum.

In this proceeding, AT&T urges the Commission to provide clarity to potential 3.5 GHz licensees and address the numerous questions raised by this unprecedented licensing regime. First, it is unclear whether the Commission intends to apply its traditional auctions framework to competitive bidding for 3.5 GHz licensees. The Commission may find that certain of its rules and procedures are not workable in the 3.5 GHz context, and it must provide greater clarity to licensees by specifying which auction procedures would be applicable. Second, the data collected by the SAS must be maintained confidentially to protect the security of commercially sensitive information, and the Commission must confirm that the SAS is acting on its behalf to provide assurance to potential licensees. Third, the Commission should maintain appropriate oversight over SAS administrators by developing an administrator selection process and permitting them to collect reasonable fees.

The proposed, novel 3.5 GHz licensing environment also raises numerous technical issues that must be resolved prior to the deployment of service in this band. Technical decisions made by the Commission must be guided by current technological realities, not by potential

future capabilities that have not been proven to be technically feasible at this time. For example, compliance with the Commission's proposed geo-location requirements is not realistic using current technology. AT&T is also concerned that the proposed interference reporting procedures have over-simplified matters of interference reporting and resolution. Similarly, further clarification from the Commission is needed regarding the proposed conducted and emitted power limits for the 3.5 GHz band. Finally, while AT&T supports the inclusion of the 3650-3700 MHz band in this licensing regime, certain technical requirements will need to be adjusted depending on whether this spectrum is incorporated into the 3.5 GHz band.

Once in operation, the 3.5 GHz band will be home to an unprecedented licensing environment governed by a highly sophisticated system to manage complexities created by diverse use of the band. The Commission can best prepare for this regime by chartering a multi-stakeholder group to address issues such as SAS certification, dynamic channel allocation, neighbor management, intermodulation, geo-location requirements and interference resolution. By assembling a diverse group of viewpoints, this effort will provide assurance to future 3.5 GHz licensees at all levels that the SAS will be administered in a manner that promotes productive use of spectrum while mitigating interference between diverse services. Such efforts have widespread support, and AT&T stands prepared to assist with such an effort.

Small cell deployment and spectrum sharing in the 3.5 GHz band will play an important role in addressing the nation's need for additional mobile broadband spectrum. The Commission has made important strides in crafting rules for this spectrum, but there are many questions left unanswered. By adopting the proposals advanced by AT&T in these Comments, the Commission will ensure a smooth and prompt roll-out of service, and will provide prospective

licensees with the certainty needed to confidently invest in this promising new spectrum environment.

II. AT&T SUPPORTS THE COMMISSION'S EFFORTS TO PROVIDE ACCESS TO ADDITIONAL WIRELESS BROADBAND SPECTRUM IN THE 3.5 GHZ BAND

A. This Proceeding Continues a Series of Commendable Efforts to Allocate Additional Spectrum for Broadband

The United States is a leader in wireless innovation, consistently at the forefront of developing cutting-edge wireless technologies, services, and applications. Spectrum plays a crucial role in facilitating the cycle of innovation and investment that characterizes the dynamic mobile wireless ecosystem. As the President has observed, with demand for mobile broadband sky-rocketing, "we must continue to make additional spectrum available as promptly as possible for the benefit of consumers and businesses" alike.[2] Indeed, the meteoric growth in mobile broadband use has caused an explosion in wireless broadband data demand which, if left unaddressed, will render available wireless spectrum inadequate to meet surging consumer demands.[3] If the United States is to maintain a leading position in advanced wireless communications, access to additional spectrum for mobile broadband must be addressed.[4]

---

[2] The White House, Presidential Memorandum: Expanding America's Leadership in Wireless Innovation (Jun. 14, 2013), *available at* http://www.whitehouse.gov/the-press-office/2013/06/14/presidential-memorandum-expanding-americas-leadership-wireless-innovatio

[3] *See* Comments of CTIA – The Wireless Association®, GN Docket No. 12-268, at 5-7 (Jan. 25, 2013) ("CTIA Incentive Auction Comments"); *Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band*, Notice of Proposed Rulemaking and Order, GN Docket No. 12-354, ¶ 2 (Dec. 12, 2012) ("*NPRM*").

[4] *See generally* Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. No. 112-96, § 6407(b), 126 Stat. 156 (2012) ("Spectrum Act") (directing NTIA to give priority to spectrum reallocations for exclusive non-Federal uses).

In response to the widely-recognized need for additional broadband spectrum, the National Broadband Plan recommended that the Commission and NTIA make a total of 500 MHz of spectrum available for broadband use by 2020, with the first 300 MHz available by 2015.[5] AT&T applauds the steps the Commission has taken since then to ensure that spectrum is cleared for commercial uses. The upcoming incentive auction, for example, represents a crucial step forward in providing a significant amount of new spectrum for mobile broadband.[6] Similarly, the planned AWS-3 auction will "play an important role in achieving the Commission's goal of making additional spectrum available for commercial, licensed mobile broadband services."[7] With the AWS-3 auction, the Commission has a rare opportunity to adopt a band plan and service rules that would effectively add 65 MHz of contiguous, prime spectrum to the existing AWS-1 allocation.[8]

The 3.5 GHz spectrum that is the subject of the *FNPRM* could also play a critical role in meeting the escalating demands for additional mobile broadband spectrum. In 2010, NTIA issued a "Fast Track Report" in which it identified the 3.5 GHz band as potentially suitable for

---

[5] Federal Communications Commission, CONNECTING AMERICA: THE NATIONAL BROADBAND PLAN, at 75 (Mar. 16, 2010), *available at* http://www.broadband.gov/plan/

[6] *Expanding the Economic & Innovation Opportunities of Spectrum Through Incentive Auctions*, Report and Order, GN Docket No. 12-268, FCC 14-50 at ¶ 2 (rel. Jun. 2, 2014) ("*Incentive Auction Order*") ("[M]aking more spectrum available for mobile broadband use, the incentive auction will benefit consumers by easing congestion on the Nation's airwaves, expediting the development of new, more robust wireless services and applications, and spurring job creation and economic growth.").

[7] Comments of AT&T, AU Docket No. 14-78, at 1 (Jun. 9, 2014) ("AT&T AWS-3 Procedures Comments").

[8] *See Amendment of the Commission's Rules with Regard to Commercial Operations in the 1695-1710 MHz, 1755-1780 MHz, and 2155-2180 MHz Bands*, Notice of Proposed Rulemaking and Order on Reconsideration, GN Docket No. 13-185 (Jul. 23, 2013) ("*AWS-3 NPRM*").

commercial broadband use.[9] This proceeding, in fact, is an outgrowth of the NTIA's 2010 recommendation, as well as the July 2012 PCAST recommendation to create "the first shared use spectrum superhighways."[10] AT&T thus commends the Commission for undertaking the instant proceeding to establish a Citizens Broadband Radio Service in the 3.5 GHz band as an additional step in addressing the spectrum crunch.[11] By harnessing the 3.5 GHz band for new uses through its innovative licensing proposals, the Commission should bolster the availability of precious broadband spectrum, thereby advancing our core national interests.

Although the Commission's actions so far represent important progress towards allocating additional spectrum resources to meet the demand for mobile broadband services, there is more work left to be done. Commenters agree with AT&T that the Commission should principally focus on freeing up additional spectrum below 3 GHz for dedicated, exclusive-use licensing.[12] As AT&T has explained, exclusive-use licensing remains the highest and best use of spectrum, and is the cornerstone for attracting investment in mobile broadband.[13] While exclusive use licensing must continue to be the primary methodology for providing new

---

9 *Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band*, Further Notice of Proposed Rulemaking, GN Docket No. 12-354 at ¶ 9 (Apr. 23, 2014) (*"FNPRM")*.

10 *Id.* ¶ 10.

11 *Id.* ¶ 2.

12 *See, e.g.*, Comments of CTIA – The Wireless Association®, GN Docket No. 12-354, at 6 (Feb. 20, 2013) ("CTIA February 2013 Comments"); Comments of Nokia, GN Docket No. 12-354, at 4 (Feb. 20, 2013) ("Nokia February 2013 Comments"); Comments of Microsoft, GN Docket No. 12-354, at 1 (Feb. 20, 2013) ("Microsoft February 2013 Comments") (noting that the 3.5 GHz band is "by no means a substitute" for exclusive-use spectrum).

13 *See, e.g.*, Comments of AT&T Inc., GN Docket No. 12-354, at 2-3 (Feb. 20, 2013) ("AT&T February 2013 Comments"); Comments of AT&T Inc., ET Docket No. 10-123, at 2-3 (Apr. 22, 2011) ("AT&T 2011 Spectrum Comments").

spectrum resources for mobile broadband, AT&T recognizes that there may be a complementary role for spectrum sharing as well. Consequently, AT&T supports the Commission's proposal to use the 3.5 GHz band as a test case to determine the feasibility of broader spectrum sharing between commercial and Federal spectrum users. As this spectrum is above 3 GHz, its propagation characteristics make it an excellent candidate for implementation of small cell technology as an adjunct to macrocell wireless broadband networks.

B. The 3.5 GHz Band is Ideal for Small Cell Deployments and Could Provide a Launch Pad for the Introduction of Innovative Services

AT&T supports the Commission's proposal to use the 3.5 GHz band for small cell deployments.[14] AT&T also supports continued use of this spectrum for point-to-point and point-to-multipoint use. As the Commission has recognized, the problems that make the 3.5 GHz band ill-suited for exclusive-use licensing—limited signal propagation and the presence of incumbent users—do not hinder the band's effectiveness for small cell transmissions.[15] Indeed, it is likely that, with the proper regulatory regime in place, small cells and backhaul use could flourish in the 3.5 GHz band. Small cells have lower antenna heights, lower transmit power, and their limited signal propagation can facilitate deployment with a reduced risk of harmful interference to geographically or spectrally adjacent users.

Small cell deployments in the 3.5 GHz band may serve as a component of carriers' heterogeneous access networks ("HetNets"). HetNets use a combination of small cells, macrocells, and Wi-Fi infrastructure to maximize the efficient use of available spectrum. Increasingly, HetNets are playing a critical role in handling heavy traffic loads in high use areas.

---

[14] Small cells are "low-powered wireless base stations intended to cover targeted indoor or localized outdoor areas." *NPRM* ¶ 3. Typically, they "provide wireless connectivity in areas that present capacity and coverage challenges to traditional wide-area macrocell networks." *Id.*

[15] *See id.* ¶¶ 19-20.

In particular, HetNets allow smaller cells to operate in an optimized manner to achieve greater frequency reuse and increase cellular capacity within macrocells.[16] Commenters agree that deploying small cells in the 3.5 GHz band could help wireless providers fortify their HetNets and increase capacity.[17] Thus, by accommodating small cell deployment in the 3.5 GHz band, the Commission will allow mobile carriers to expand the capacity of their networks, ultimately benefitting consumers.

Small cell deployments in the 3.5 GHz band may also promote advancements in machine-to-machine ("M2M") applications, an important developing communications market. Because they offer discrete, niche opportunities, M2M applications are at the forefront of innovative wireless development. M2M applications, which could be supported by small cell technology, present endless opportunities, from allowing diabetics to receive continuous, flexible insulin doses through real-time glucose monitoring sensors[18] to permitting remote security monitoring through audio, video, vibration, and other sensory technology.[19] Although the potential for creative M2M applications is still growing, such applications are necessarily limited by wireless signal strength and bandwidth capacity. Indeed, M2M solutions can be limited in

---

16 *See* Comments of Qualcomm, Inc., ET Docket No. 10-123, at ii-iii (Apr. 22, 2011) ("Qualcomm Spectrum Comments").

17 *See, e.g.,* Comments of Public Interest Spectrum Coalition, GN Docket No. 12-354, at 10 (Feb. 20, 2013) ("PISC February 2013 Comments"); Comments of the Telecommunications Industry Association, GN Docket No. 12-354, at 3 (Feb. 20, 2013) ("TIA February 2013 Comments").

18 *See* Genachowski 2011 TIA Prepared Remarks, at 4.

19 *See* Comments of Verizon and Verizon Wireless, WC Docket No. 13-97, at 8 (Jul. 19, 2013) ("Verizon Numbering Comments"). The growth in number and importance of M2M applications is unprecedented. Through M2M applications, telematics devices in automobiles may be able to contact 911 when they detect an accident and rental car customers may reserve cars through wireless devices. *Id.* at 8-9.

indoor and below-ground environments. Accordingly, small cell solutions could increase network capacity in such areas to better support the growth of important M2M applications.[20]

III. THE COMMISSION SHOULD CONSIDER A TRANSITIONAL APPROACH FOR ACCESS TO THE 3.5 GHZ BAND

In the *FNPRM*, the Commission has proposed the use of a novel SAS for mediating access to the 3.5 GHz band. The Commission envisions several core functions to be performed by the SAS.[21] These functions include:

- Determination of the available frequencies at a given geographic location and assignment of frequencies to Citizens Broadband Service Devices ("CBSDs");
- Determination of the maximum permissible radiated transmission power level for CBSDs at a given location and communication of that information to the CBSDs;
- Registration and authentication of the identification information and location of CBSDs;
- Enforcement of Exclusion Zones to ensure compatibility between Citizens Broadband Radio Service users and incumbent Federal operations;
- Protection of Priority Access Licensees from harmful interference from General Authorized Access ("GAA") Users;
- Reservation of the use of GAA channels in a Contained Access Facility; and
- Ensuring secure transmission of information between the SAS and CBSDs.

As the Commission observes, "[t]he overall effectiveness of our proposals depends largely on the development and implementation of a robust SAS."[22] The Commission has thus

---

[20] Similarly, smart cells may help propel utilities' efforts to deploy smart grids and similar applications that require additional communications capabilities to new heights. Specifically, by increasing network capacity, smart cells may help support greater visibility further into smart grids. *See* Comments of the Utilities Telecom Council, the Edison Electric Institute, and the National Rural Electric Cooperative Association, GN Docket No. 12-354, at 7 (Feb. 20, 2013) ("UTC, EEI, and NRECA February 2013 Comments").

[21] *FNPRM* ¶ 95.

[22] *Id.* ¶ 90.

envisioned a highly sophisticated and complicated system that, if properly implemented, will play a critical role in ensuring productive and innovative use of the 3.5 GHz band. However, given the unique and unprecedented nature of this system, the Commission must allow significant time for the SAS to be developed and devote the resources necessary to ensure the SAS is successfully implemented.

A. While the Novel SAS May Prove a Good Approach for Managing the 3.5 GHz Band, the SAS Should Not Be Used to Dynamically Assign Frequencies and Control Access for PALs

AT&T opposes the *FNPRM* proposal to use the SAS to dynamically assign frequencies and control access for priority access licenses ("PALs"). Instead, PALs should have assigned specific frequency assignments and geographic boundaries at the initiation of use for the 3.5 GHz band. As detailed *infra*, Priority Access licensees should be provided a period of time to construct and operate their systems without any dynamic channel assignment within their assigned spectrum. Only at the end of the initial license term, if there is spectrum or geography *not* in use by Priority Access licensee, should GAA use occur in PAL assigned spectrum. Additionally, AT&T believes that dynamic spectrum assignment for PALs will be problematic unless significant spectral inefficiencies are eliminated.

1. Spectrum In Use Under a PAL Should Not Be Available for Dynamic Assignment

Fundamentally, AT&T believes that any spectrum provided under a PAL should not be subject to GAA usage unless it is not being used by the licensee. To quantify which channels are in use, AT&T suggests that the Commission refer to the 3GPP standards for TD-LTE channel

occupancy. The key factor when determining if a TD-LTE channel is in use (occupied) is from studying the various control channels integrated into the standard.[23]

TD-LTE uses Orthogonal Frequency Division Multiple Access ("OFDMA") where the time domain operates with a 10 millisecond radio frame structure. Each 10 millisecond radio frame is divided into ten subframes of 1 millisecond duration each. Each subframe is further divided into two slots of 0.5 millisecond duration each. Thus, a 10 millisecond radio frame contains 20 slots of 0.5 millisecond duration each. Each 0.5 millisecond slot is further divided into 7 OFDM symbols.

TD-LTE transmits certain control channels within the above described frame structure regardless of the presence of user traffic in the network as explained below:

Synchronization Signals. TD-LTE base stations transmit a Primary Synchronization Signal ("PSS") in the 3rd symbol of the 3rd and 13th slots of each radio frame, and a Secondary Synchronization Signal ("SSS") in the last symbol of the 2nd and 12th slots of each radio frame. These synchronization channels are continuously transmitted in their designated positions in the OFDMA frame structure regardless of whether there are active devices in the network to allow any new devices to be able to detect and synchronize with the TD-LTE network. Any disruption in the transmission of these synchronization signals would have a significant detrimental effect on the TD-LTE network.

Broadcast Channel. The Physical Broadcast Channel ("PBCH") is transmitted in the 2nd slot of each radio frame to transmit critical network information to devices in the TD-LTE network. Transmitted PBCH information includes the Master Information Block ("MIB"), which includes the most important parameters needed for a device to access the TD-LTE cell,

[23] *See* 3GPP TS 36.211, *available at* http://www.3gpp.org/DynaReport/36211.htm (last visited July 8, 2014).

and other System Information Blocks ("SIBs") that contain many other essential parameters related to cell access, channel configuration, etc. As with the PSS and SSS, the PBCH is transmitted regardless of the presence of any traffic in the TD-LTE network, and any disruption to its transmission would have a significant detrimental effect on the TD-LTE network.

Random Access. Devices that need access to a TD-LTE network use the uplink part of special subframes ("UpPTS") in TD-LTE to perform random access to the serving base station. This is usually one of the first requests a device makes to the base station to access the network and request transmission resources. Any disruption in a device's ability to transmit on this random access channel can render a TD-LTE inaccessible to devices trying to gain access to the network.

Uplink Channel Sounding. Devices also use the uplink part of special subframes ("UpPTS") in TD-LTE to transmit the uplink Sounding Reference Signal ("SRS"). This allows the TD-LTE base station to estimate uplink channel quality (used for link adaptation and channel-dependent scheduling). Also, due to reciprocity in the TDD channel, this estimate of uplink channel quality is also used for optimizing downlink transmissions. Disruptions in a device's ability to transmit SRS at designated periods may significantly harm the performance of a TD-LTE network.

Physical Downlink Control Channel. The first two to three symbols of downlink and special subframes are used by the base station to transmit the Physical Downlink Control Channel ("PDCCH"), which is monitored by devices to detect whether they have been granted resources for transmitting or receiving data in particular subframes. Hence, devices that may not be transmitting or receiving any data on the TD-LTE network may still be monitoring the PDCCH.

As illustrated above, the TD-LTE system has a very sophisticated arrangement of critical control channels embedded within a fine-grained timing structure that are required to be operated unobstructed to ensure proper performance of a TD-LTE network. AT&T suggests that the monitoring of these control channels is critical to determining if particular spectrum is being used in the 3.5 GHz band. If the TD-LTE control channels are in use, it would be clear that the Priority Access licensee is using the spectrum resources in a particular market and that no spectrum is available for GAA. Once a system is registered with the SAS, the particular frequency block used by the Priority Access licensee should be considered as occupied. The above mentioned control channels would always be occupied in this case.

2. Dynamic Assignment of PAL Spectrum Would Be Inefficient, Complex and Problematic

In current wireless networks, spectrum reuse and radio resource management techniques are designed to optimize spectrum so that it is utilized in the most efficient manner possible. To coordinate universal frequency reuse throughout a network, the infrastructure has to be aware of how spectrum is being used in a geographical area, and may use this knowledge to manage how spectrum is allocated to specific subsystems. In fact, many of the innovations in cellular technology have been methods used to actually decrease noise in the channel in order to push the theoretical speeds further up the curve of Shannon's Law (the lower the interference, the higher the capacity gains).[24]

Such strict requirements can be achieved in a highly spectral efficient technology such as LTE, because LTE is designed to operate in high-interference environments by having the ability

[24] The Shannon-Hartley theorem provides the maximum data rate over a communications channel in a particular bandwidth in the presence of noise. *See e.g.,* http://en.wikipedia.org/wiki/Shannon%E2%80%93Hartley_theorem (last visited June 30, 2014).

to selectively use a subset of subcarriers at particular times and to avoid frequencies which are subject to excessive interference. The wireless provider operating an LTE network has: (1) precise knowledge of interfering channels in a fast changing RF environment, (2) adaptable transmission modes, and (3) defined protocols between interfaces. All of this is achieved with low latency and with minimal power consumption.

In 3GPP coordinated networks, awareness and management rely on a communication framework between the systems (base stations & mobile devices) using the spectrum. The awareness comes from the systems providing feedback to the coexistence infrastructure on the local RF environment and providing insight into how the network intends to use the spectrum. As defined by standardization protocols and process, the controller collects and estimates the sensing information and uses sophisticated algorithms to optimize frequency allocation.

HetNet deployment (as that envisioned in 3.5 GHz where different CBSDs are operating at different power levels as determined by the SAS) increases the potential of uplink and downlink interference due to the varying power levels that can be transmitted by different CBSDs. To make the decision on frequency allocation and power level management, the key challenge will be to manage inter-cell interference and to make intelligent optimization and synchronization decisions on multi-vendor and multi technology CBSDs in a fast changing RF environment. This has to be accomplished with low latency. In a closed system like LTE, managing interference is the crux of advanced LTE techniques. When managing a single LTE network, the level of interference is predictable and somewhat consistent across cells and across city-by-city deployments. In contrast, the interference from various systems could vary tremendously across the coverage area in the scenario proposed by the Commission for the 3.5 GHz band.

LTE and LTE-Advanced cellular networks operate in a rapidly changing radio environment where LTE base stations can dynamically allocate time-frequency resource blocks to users with a time granularity of 1 millisecond and frequency granularity of 180 kHz.[25] This means that interference in an LTE network can be highly dynamic and unpredictable. There are a number of interference management techniques designed in LTE-Advanced specifications to help an LTE base station or device (depending upon uplink or downlink) manage the interference received from other nearby LTE base stations or devices (again depending upon uplink or downlink). These techniques generally fall under the categories of interference coordination or cancellation.

Interference coordination may be accomplished through use of Coordinated Multi-Point Transmission ("CoMP"), a family of coordination techniques where a cluster of cells coordinate with each other to improve user performance.[26] Additionally, coordination is managed through Enhanced Inter-Cell Interference Coordination ("eICIC"), a set of techniques where small base stations coordinate with larger macro base stations to manage amount of interference experienced by cell edge users being served by small base stations.[27]

---

[25] *See* 3GPP TS 36.211, *available at* http://www.3gpp.org/DynaReport/36211.htm (last visited July 8, 2014).

[26] *See* "4G Mobile Broadband Evolution, 3GPP Release 11 & Release 12 and Beyond," 4G Americas White Paper, *available at* http://www.4gamericas.org/documents/4G%20Mobile%20Broadband%20Evolution%20Rel-11%20%20Rel%2012%20and%20Beyond%20Feb%202014%20-%20FINAL.pdf (last visited July 8, 2014).

[27] *Id.*

Interference cancellation is managed by Network-Assisted Interference Cancellation and Suppression ("NAICS"). NAICS provides cancellation or suppression of LTE inter-cell interference at LTE devices assisted by information provided by the network.[28]

The above interference coordination/cancellation techniques are specifically designed to manage real-time LTE-specific interference created in the network. A centralized spectrum manager will not be able to operate such interference coordination features because it will not have the tight latency and time synchronization required to perform real-time coordination in an LTE network. Moreover, if a centralized spectrum manager were to dynamically allocate geographically adjacent census blocks to operators using different air interface technologies (LTE vs. non-LTE); such interference coordination/cancellation techniques would not be able to mitigate the interference caused to the LTE network or vice versa. This would likely cause harmful interference and undue degradation of network performance in both adjacent networks.

3. PALs Should Have Specific Frequency Assignments and Geographic Areas of Operation

Given the difficulties associated with real-time interference coordination and cancellation, AT&T submits that PALs should have specific frequency assignments within a defined service area and frequency assignments should not be dynamically controlled by the SAS. As indicated above, PALs in the 3.5 GHz band could play an important role in carriers' deployment of HetNets. The PAL will be but one component of a highly integrated, highly diverse network. If the Commission allows the SAS to change the frequency allocated under a PAL, this will impair the licensee's ability to manage such a complicated network. Further, from the *FNPRM* it appears that the SAS would not be able to perform real-time interference-

---

[28] *Id.*

mitigation functions that the Commission envisions.[29] Because of high user mobility, to manage interference, the SAS would need to control and/or determine the operating power and frequency of all the systems in the environment. Because AT&T does not see how all of those parameters could be provided to the SAS within the necessary time constraints, the SAS will not be able to manage interference and therefore could not dynamically provide frequency assignments.

For the reasons described above, the Commission could best facilitate productive and efficient use of the 3.5 GHz band by maintaining consistent assigned frequencies for individual PALs. Under this framework, Priority Access licensees' interactions with the SAS would instead be registration functions that inform the SAS when a system has gone into service in the licensed service area. Wireless providers holding PALs would then be able to utilize the spectrum as efficiently as possible while ensuring no harmful interference to incumbents within the operating area. By providing licensing information to the SAS, the SAS will be able to manage the GAA use outside of the PAL area. AT&T believes that this methodology is the only efficient and effective way of licensing PALs to wireless broadband providers.

B. The SAS Will Require Significant Time and Effort To Develop

The SAS envisioned by the Commission is a first-of-its-kind development, and the Commission has envisioned an extremely ambitious framework for 3.5 GHz licensing. As such, AT&T expects extensive testing and proof-of-concept efforts prior to the deployment of a SAS. Indeed, before the SAS framework can be implemented, the Commission must ensure that certain criteria are met. Most importantly, proposed SAS administrators must provide certainty that the functionalities outlined by the Commission are provided within their implementation of SAS.

---

[29] *See FNPRM* ¶ 33 ("The SAS would assign and maintain appropriate frequency assignments and ensure that lower tier users do not interfere with higher tier users.").

All three tiers of users must be comfortable with the assumptions made by SAS administrators with respect to both interference and operational parameters. Federal and satellite earth station incumbents must be certain that their operations will be protected by the SAS. Priority Access licensees must be assured that spectrum resources authorized to them are interference-free and that those resources are not inappropriately re-dedicated to other users. Finally, GAA users must be comfortable that the algorithms used by the SAS will allow actual dynamic use of the available spectrum, without causing interference to higher tier users.

The Commission's vision for the SAS is an ambitious one, and it will require a considerable amount of advance testing before it can be put into use. However, the need for additional mobile spectrum is critical. Just as the Commission should not rush into service a SAS that is not fully functional, the Commission should not allow necessary SAS testing and preparation to force this spectrum to lie fallow. As discussed below, by adopting a transitional licensing approach, the Commission will give the SAS development process the time and attention it requires, while making efficient use of available spectrum resources.

C. During SAS Development, the FCC Should Use a Transitional Approach to Licensing the 3.5 GHz Spectrum

As noted above, the Commission should not simply await completion of necessary SAS testing prior to permitting access to the 3.5 GHz band. By adopting a transitional licensing approach to the 3550-3700 MHz band, the Commission will allow this spectrum to be put to use quickly, even while the SAS is in development. Transitional licensing strikes a compromise that will best serve the public interest. Furthermore, the transitional licensing approach will allow the 3.5 GHz ecosystem to develop in a manner that may inform various issues with respect to the SAS implementation. AT&T's proposal for a transitional licensing framework is outlined below.

1. The 3650-3700 MHz Band Should Be Available for CBDS

As an initial matter, AT&T supports combining the 3650-3700 MHz spectrum with the pool of available spectrum for CBDS devices. This will provide 150 megahertz of spectrum to be made available for commercial use and allow for additional spectrum for both PAL and GAA users. This proposal has the support of several participants in this proceeding. For example, T-Mobile observed that by extending its 3.5 GHz licensing framework to the 3650-3700 MHz band, the Commission will "increase the utility of the band, benefitting existing operators, attracting new providers, and fostering a large, innovative equipment market."[30] Motorola Mobility, meanwhile, asserted that extending the Commission's framework to 3650-3700 MHz would meet the Commission's policy goals of making additional mobile broadband spectrum available while promoting interference mitigation techniques and spectral efficiency.[31] And Google noted that "[m]ore contiguous spectrum can support more uses, attract more services, and encourage expansion of the equipment market—all of which will increase the intensity and diversity of 3.5 GHz operations."[32] AT&T agrees with those commenters who support adding the 3650-3700 MHz band to the Commission's 3.5 GHz licensing framework, and concurs that this spectrum should be put to use as soon as possible. Under the transitional licensing framework envisioned by AT&T, this would allow 150 MHz of spectrum to be put to use while stakeholders continue to develop the capabilities of the SAS. However, as noted in the technical section below, AT&T believes that special provisions must be put in place to support the

---

30 Comments of T-Mobile USA, Inc., GN Docket No. 12-354, at 14 (Dec. 5, 2013) ("T-Mobile December 2013 Comments").

31 Comments of Motorola Mobility LLC, GN Docket No. 12-354, at 7 (Dec. 5, 2013) ("Motorola Mobility December 2013 Comments").

32 Comments of Google Inc. on the Proposed Revised Framework, GN Docket No. 12-354, at 13 (Dec. 5, 2013) ("Google December 2013 Comments").

continued use of the 3650-3700 MHz band for point-to-point and point-to-multipoint services. Unlike the 3550-3650 MHz spectrum, the 3650-3700 MHz band has had commercial licensing for a number of years and the investments and developments in this spectrum should be protected by the new licensing regime.

2. Interference Can Be Mitigated During the Transition Period

Further, the Commission should not be concerned that AT&T's proposed transitional licensing framework would result in interference, either before or after the transition. Existing LTE technology will enable PALs to fully protect incumbent operations, including Federal systems. This is because LTE standards include protocols to protect incumbent government operations.[33] Additionally, in a TDD-based system as is expected for the 3.5 GHz band, both the user devices and the CBSDs transmissions occur in the same spectrum band. The issue that will determine the extent of any needed exclusion zone is the transmission from CBSDs into ship borne radar receivers. AT&T believes that further studies can be taken up by 3GPP that can provide full protection to Federal incumbents with a smaller exclusion zone. As such, a functioning SAS is not a prerequisite to a 3.5 GHz spectrum sharing regime that allows PAL use to proliferate while ensuring that incumbents receive necessary protections. Moreover, as noted above, AT&T does not believe that the SAS should dynamically assign spectrum resources to PALs. As the SAS will simply provide a registration function for PALs, there is no need to await the full implementation of the SAS prior to allowing PALs to be authorized and allowed to operate.

---

[33] *See, e.g.*, Supplemental Comments of Verizon and Verizon Wireless, GN Docket No. 12-354, at 8-9 (Dec. 5, 2013) ("Verizon December 2013 Comments"); Comments of Nokia Solutions and Networks US LLC, GN Docket No. 12-354, at 18 (Dec. 5, 2013) ("Nokia December 2013 Comments") ("LTE technology uses very sophisticated Transmit Power Control to adjust the transmit power of the LTE devices and prevent interference, ensuring efficient spectrum sharing.").

GAA could also be provided during the transition period so long as usage was outside of the protection zones for Federal incumbents and coordinated with existing earth station incumbents. Presumably GAA proponents will need to rely upon geo-location capabilities to ensure these requirements are met and will need to coordinate with Federal and commercial incumbents on their transitional approach. Moreover, GAA usage in this manner could form the basis for the initial SAS development and establishment of SAS administrators.

3. PAL and GAA Uses Should Be Separated During the Transition Period

AT&T proposes that during the transition period, spectrum use should be bifurcated between PAL and GAA users. While AT&T is confident that existing LTE protocols will prevent interference from PALs to protected incumbent users, spectrum sharing between PAL and GAA users requires further development. Once the SAS concept is developed and tested, more sharing between tiers of licensees could be established. However, there is no need to delay the use of the spectrum during this time. By segregating the GAA and PAL uses at the outset, both classes of licensees would be able to begin operations with a level of assurance that service quality will be maintained, and this will permit investment in devices for the 3.5 GHz band, as well as enable rapid spectrum usage.

D. AT&T Supports a Detailed Licensing Framework for Transitional Use of the 3.5 GHz Band

As explained further below, AT&T believes that the Commission should adopt a detailed transitional licensing framework for the 3.5 GHz that will enable its productive use while the SAS is under development. AT&T submits that its proposed framework will help facilitate a smooth transition to the SAS system once it becomes available. In the interim, this framework will provide 3.5 GHz spectrum users with the certainty and stability needed to invest and deploy innovative services in this band.

1. The Commission Should Initially Divide the Band Into Licensed and Unlicensed Blocks

AT&T believes that, during the transitional period, the Commission should split the 3.5 GHz spectrum into licensed and unlicensed segments. Significant amounts of spectrum should be made available for both PAL and GAA users during the transition period such that these parties can invest and develop technology for the 3.5 GHz band. As discussed above, during the transitional period, the Commission should restrict GAA use of PAL channels, even when the channel is not in use. Once the transitional period is complete, if there is spectrum or geography not in use by a Priority Access licensee, GAA use could occur in PAL-assigned spectrum. In such cases, however, GAA users should be required to clear a PAL channel after a PAL resumes its use.

2. The Commission Should Provide License Terms for PALs that Offer Necessary Certainty to Licensees, including a renewal expectancy

The Commission has proposed limiting license terms to one-year "with no renewal," such that PALs "automatically terminate at the end of each year."[34] The Commission theorizes that such an approach will "promote flexibility, simplify administration, and promote fungibility."[35] These potential benefits are heavily outweighed, however, by the hardship that the proposed licensing scheme would impose on PALs. Under the proposed regime, no matter what a licensee might deploy, there will be uncertainty as to whether it will continue to have access to the spectrum it uses to serve its customers after the license term is over, and if so, at what cost. Licensees could later be outbid or forced to bid so much to maintain access to the spectrum that providing service will become uneconomical. The uncertainty inherent in such a licensing

34 *FNPRM* ¶ 49.

35 *Id.*

structure would thwart investment, hinder deployment, and dampen innovation in the 3.5 GHz band. To ensure that the 3.5 GHz band thrives, the Commission must provide PALs with greater certainty.

Under the proposed licensing regime, a licensee would face the potential loss of its licensed spectrum even if it fully deploys the spectrum during the short license term.[36] Put simply, a one-year, non-renewable license is insufficient assurance to spark investment in the 3.5 GHz band. Investors need greater certainty that they can earn a fair return on their investment in the band. One-year terms and no renewal expectancy also raise the possibility of stranded investment.[37] In fact, even the proposed opportunity to aggregate 5 consecutive one year licenses is not sufficient to provide the certainty required for investment. Moreover, potential customers such as large retailers seeking in-building coverage also need assurance that they will have continuity of service without having to find a new service vendor every year or two. Licensees may thus be reluctant to invest in innovative products and services if they have no expectancy in them beyond the short one-year license term.

The combination of short license terms and lack of renewal expectancy is particularly troublesome where, as here, deployment promises to be complex and time intensive. Because it is "difficult to see how such a framework provides the predictability for infrastructure investment" and deployment may "require multi-year planning and deployment horizons,"

---

[36] *See* T-Mobile December 2013 Comments at 5 (noting that the current proposal would allow licensees to accumulate consecutive licenses with no clear requirement to use the spectrum); *see also FNPRM*, Separate Statement of Commissioner O'Reilly at 1 ("There is no certainty that, after making the capital expenditure during that time . . . a licensee would be able to continue its priority access.").

[37] Reply Comments of CTIA – The Wireless Association®, GN Docket No. 12-354, at 4 (Dec. 20, 2013) ("CTIA December 2013 Reply Comments").

commenters have suggested that the FCC adopt longer license terms and renewal expectancies.[38] Moreover, as AT&T has explained, small cell deployment may well take years to accomplish.[39] To deploy small cells, carriers must first overcome several logistical obstacles, including site acquisition, securing local zoning approval, and acquiring construction permits. In some cases, complications may also arise, causing further deployment delays. For example, in dense urban cores, a litany of prior approvals may be required by authorities and, if a proposed deployment site is historic, additional approvals must be obtained before deployment can even begin. Often, these circumstances are beyond the control of carriers and can dictate the amount of time deployment will require. Confronted with such challenges, small cell deployment is likely to require substantial time and effort.[40]

Rather than experimenting with short-term licensing concepts when deployment in the 3.5 GHz band is likely to be complex and time consuming, the Commission should infuse PALs with certainty and provide for PAL renewal expectancies.[41] Even if the Commission affords licensees the option to aggregate PALs for multiple years,[42] the FCC should still allow some

---

38 Comments of Ericsson, GN Docket No. 12-354, at 7-8 (Dec. 5, 2013) ("Ericsson December 2013 Comments") (advocating a ten-year license term); *see also* Comments of Qualcomm Inc., GN Docket No. 12-354, at 7-8 (Dec. 5, 2013) ("Qualcomm December 2013 Comments") (supporting a ten-year license term with a right of renewal).

39 *See* Comments of AT&T, WT Docket No. 13-238, at 3 (Feb. 3, 2014) ("AT&T Wireless Siting Comments") (explaining that applying federal, state, and local regulatory review processes to small cells is particularly burdensome because small cell systems are typically deployed by the dozen).

40 *See* Comments of T-Mobile USA, Inc., WT Docket No. 13-238, at 2-3 (Mar. 5, 2014) ("T-Mobile Wireless Siting Comments") (describing municipal efforts to prevent or delay deployment of new wireless facilities, such as small cells).

41 *See* Qualcomm December 2013 Comments at 8.

42 *FNPRM* ¶ 49 (proposing to allow entities to "aggregate up to five consecutive years of licenses, through competitive bidding").

level of renewal expectancy so that carriers can accomplish robust deployment with investment confidence. In turn, the greater certainty will foster more robust deployment and strengthen innovation. AT&T submits that, to encourage proliferation of 3.5 GHz services during the transition period, the Commission should issue PALs with an initial term of three years, with a first renewal of two years. After this original five year license term, PALs will be able to renew for additional one year license terms so long as service is still provided in the licensed service area.

This license term framework will allow PALs the necessary certainty in their spectrum rights throughout their network buildout process. This is especially important during the initial launch of 3.5 GHz services, as PALs will be making considerable investments in equipment and facilities. As explained further below, to the extent the Commission is concerned that longer initial license terms will slow the deployment process, the Commission can impose reasonable performance requirements on PALs.[43]

3. The Commission Should Adopt Census Tracts as the License Area

In the *FNPRM,* the Commission has proposed to issue PALs on the basis of census tracts.[44] In making this proposal, the Commission posited that "census tracts offer a variety of benefits, including geographic sizes varying by population density, nesting into other political subdivisions including city lines, and aligning with other natural features that track population density."[45] While AT&T supports the Commission's proposal to use census tracts, it notes that using a census tract as a license area is not without complications. In particular, the use of

---

43 *See* discussion in Section III(D)(4) of performance requirements.

44 *FNPRM* ¶ 44.

45 *Id.*

census tracts will result in the need for considerable additional coordination by licensees at border areas, and the location of census tract borders (for example, in the middle of a street) sometimes makes frequency coordination difficult. The Census Bureau also modifies census tracts on a fairly regular basis, making the determination of the licensed service area highly changeable and dictated by the date that the authorization is issued by the Commission. For this reason, AT&T submits that if the Commission uses census tracts as the license area for 3.5 GHz licensees, the Commission should allow Priority Access users to request frequency assignments that would mitigate the need for extensive border coordination. This could include the exchange of frequencies between licensees in the same census tract to mitigate interference.

4. The Commission Should Adopt Reasonable Performance Requirements

As noted above, to the extent that the Commission's desire to establish one year, non-renewable license terms results from concerns about spectrum warehousing, the Commission can more effectively manage this issue by imposing reasonable performance requirements on 3.5 GHz licensees. For example, the Commission could require that PALs partially deploy service by the end of their initial license term, and that licenses may not be assigned and/or transferred in the absence of a deployment. Further, the Commission could adopt some a "keep what you use" regime where, at the end of a license term, the licensed area reverts to the licensee's actual service area – the geographic areas that are served and where facilities are in operation at the license renewal date.

5. Initial Spectrum Assignments Can Be Provided to the SAS When the Transition is Complete

As indicated above, what AT&T proposes herein is a transitional licensing framework that could commence prior to the implementation of the SAS. Once the SAS is up and running, AT&T believes that the shift of coordination could be smoothly implemented. Once the SAS has

been certified, PALs could register with the SAS, and the SAS could then assume management of the frequencies. Because the SAS should not engage in the dynamic allocation of spectrum resources for PALs, the registration process for PALs would be straightforward – they would simply provide frequency and service area covered information to the SAS. The SAS would then be in the position to protect the PAL systems, while managing GAA utilization of the spectrum.

6. Competitive Bidding Should Only Be Used If Necessary To Resolve Mutually Exclusive PAL Requests

In the *FNPRM*, the Commission has proposed that on an annual basis, it would open windows for applications for available PALs, and that mutual exclusivity (and thus, competitive bidding) would be triggered when "the total number of applicants for a PAL in a specific geographic area for a given year exceeds the number of PALs available in that geographic area for that year."[46] AT&T agrees that competitive bidding should only be required in a case of mutual exclusivity as outlined by the Commission. For example, if there are five available PAL licenses in a census tract and only four applicants for that particular license area, there is no need for competitive bidding.

Indeed, this action would be entirely consistent with the authority provided by the Commission by Congress. Section 309(j)(6)(E) clearly states that the Commission has an "…obligation in the public interest to continue to use engineering solutions, negotiation, threshold qualifications, service regulations, and other means in order to avoid mutual exclusivity in application and licensing proceedings."[47] AT&T asserts that avoiding unnecessary mutual exclusivity through the licensing process will provide a number of public interest

---

46 *Id.* ¶ 121.

47 47 U.S.C. § 309(j)(6)(E).

benefits. First, the Commission will not be required to schedule recurring auction processes for extremely large numbers of licenses in a myriad of markets (potentially 7 to 8 licenses authorized in over 70,000 census tracts). Second, potential 3.5 GHz licensees would not be subject to unneeded participation in a highly complex competitive bidding process where there is sufficient spectrum and licenses to meet the demand for all parties. Finally, avoidance of mutual exclusivity will speed the licensing process, allowing the use of the 3.5 GHz spectrum in the most expeditious manner possible.

IV. THE UNPRECEDENTED LICENSING REGIME RAISES NUMEROUS QUESTIONS

A. The Commission Must Provide Additional Clarity on the Auctions Process

While AT&T agrees with the Commission's proposal that mutually exclusive PAL applications should be resolved through competitive bidding, it submits that the Commission must specify the exact auction procedures that would apply in such situations.[48] In particular, the *FNPRM* is unclear as to whether the Commission intends to apply its traditional auction framework to competitive bidding for 3.5 GHz licenses or whether it intends to adopt an alternative model. The Commission must provide more clarity for potential licensees by specifying the auction procedures that it intends to apply.

In determining whether to apply its typical auction framework to the 3.5 GHz band, AT&T submits that the Commission should be mindful that there will likely be considerable auction activity within the band on a regular basis. As a result, wholesale adoption of certain traditional auction procedures may not be appropriate with respect to PALs. For instance, a high-volume of auction activity on a regular basis makes it clear that the Commission's broad

---

[48] *FNPRM* ¶¶ 118-125.

"prohibited communications" rule would be inappropriate in this context. Section 1.2105(c) of the Commission's rules prohibits communications regarding bids, bidding strategies, and settlement agreements between short-form applicants proposing to bid on licenses in the same geographic area.[49] The prohibition extends from the short-form application deadline until the down payment deadline.[50] With potentially constant auction activity and broad industry participation, the repeated and continual imposition of auction "quiet periods" would certainly impair secondary markets and reduce participation in the 3.5 GHz band. The Commission should carefully consider whether to eliminate this rule, which does not prohibit collusion, but prohibits the communication or receipt of any information that might potentially foster collusion. It is difficult to see what this rule adds to the deterrent effect of the criminal and treble damage penalties of the antitrust laws in terms of preventing collusion, but it certainly chills secondary market activity and limits auction participation.

B. The Data Collected by the SAS Must Be Protected

As envisioned by the Commission, the SAS would retain information on "all operations within the 3.5 GHz Band."[51] In particular, a CBSD would be required to provide the SAS with its geographic location, antenna height above ground, requested authorization status, unique FCC identification number, and unique serial number.[52] Given the depth and breadth of the information that the Commission contemplates the SAS gathering, the SAS would obtain a wealth of commercially sensitive information about the networks of multiple carriers at various

---

49 47 C.F.R. § 1.2105(c).

50 *Id.*

51 *FNPRM* ¶ 99.

52 *Id.* ¶ 62.

locations. The Commission should clarify that the information transmitted to the SAS will be for registration purposes only and that licensees need not submit information about network performance to the SAS.

Even with this limitation, the level of detail and sensitivity of the information that the Commission envisions the SAS collecting gives rise to reasonable concerns about the security and proper use of the SAS-collected data. AT&T believes that the Commission should provide further protections for the data that the SAS collects. Specifically, the Commission should make clear that spectrum assignment is an FCC function and therefore, all data that is collected by the SAS is collected on behalf of the FCC and will be maintained confidentially by the SAS as the FCC's agent. Further, AT&T suggests that the FCC contract with a vendor qualified and approved by the Department of Defense, National Telecommunications & Information Administration ("NTIA"), and the General Services Administration ("GSA") as a "work made for hire" to ensure that the FCC owns the SAS system software. In doing so, the Commission will help provide potential licensees with greater assurance that their commercially sensitive network data will not be misused and that the 3.5 GHz ecosystem will not be hostage to a commercial enterprise using a proprietary SAS system.

C. AT&T Supports the Appointment of SAS Administrators and Allowances for Reasonable Fees

The Commission has proposed that SASs would be operated "only by designated SAS Administrators that have been approved by the Commission."[53] In particular, SAS Administrators would be required to:

- Maintain a regularly updated database that contains the information described in the proposed rules;

---

53 *Id.* ¶ 105.

- Establish a process for acquiring and storing in the database necessary and appropriate information from the Commission's databases;
- Establish and follow a process for ensuring compatibility between Citizens Broadband Radio Service users and Incumbent Users, including enforcement of Exclusion Zones;
- Establish and follow processes for registering and coordinating PAL and GAA users;
- Establish and follow protocols and procedures to ensure that Incumbent Users are protected from harmful interference from Citizens Broadband Radio Service operators;
- Establish and follow protocols and procedures to ensure that Priority Access Licensees are protected from harmful interference from Priority Access and GAA users;
- Establish and follow protocols and procedures to ensure that all communications and interactions between the SAS and CBSDs are accurate and secure;
- Make its services available on a non-discriminatory basis;
- Respond in a timely manner to verify, correct or remove, as appropriate, data in the event that the Commission or a party brings claim of inaccuracies in the SAS to its attention;
- Securely transfer the information in the SAS to another designated entity in the event it does not continue as the SAS administrator at the end of its term;
- Cooperate with other SAS Administrators to develop a standardized process for coordinating and exchanging required information; and
- Provide a means to make public information available to the public in an accessible manner; and establish protocols to maintain appropriate security clearances and other security measures as may be determined by the Commission for access to and storage of required federal incumbent information if required in future phases of this proceeding.[54]

The Commission further proposes allowing the SAS Administrators to collect reasonable fees from PAL and GAA users for use of the SAS and associated services.[55]

AT&T supports these proposals. Creating SAS Administrators will be beneficial in providing some level of control for the Commission to exercise over SAS management. The Commission approval process coupled with the SAS Administrator requirements as outlined

---

54 *Id.* ¶ 106.

55 *Id.* ¶ 107.

above strikes the appropriate balance of Commission control over the SAS without providing "overly prescriptive and detailed rules" about implementation.[56] In addition, the approach is consistent with the Commission's rules regarding TV bands database administrators.[57] AT&T further supports allowing SAS Administrators to collect reasonable fees for similar reasons. Permitting SAS Administrators to collect reasonable fees from PAL and GAA users is both practical and advisable to compensate SAS Administrators for their efforts. Moreover, as proposed, the Commission will review fees and require changes in the event that the fees being charged are excessive.[58] Adopting these proposals will help facilitate the efficient administration of the SAS with appropriate Commission oversight.

D. Federal Incumbent Exclusion Zones Should Be Revisited

AT&T agrees with those commenters and FCC Commissioners who have called for a re-examination of the required Federal incumbent exclusion zones in light of the Commission's vision for the 3.5 GHz band. As several parties have noted, the exclusion zones the Commission proposes to codify were premised on assumptions that time has not borne out. To facilitate investment and innovation in the 3.5 GHz band, the Commission must work to facilitate widespread use of the spectrum through the reduction of exclusion zones.

In its July 2012 report, PCAST envisioned a "shared spectrum superhighway" that would "stimulate needed private sector investment in mass-market technologies, devices and services designed to operate by sharing underutilized capacity in . . . Federal bands."[59] PCAST noted that

---

56 *Id.* ¶ 105.

57 *See* 47 C.F.R. § 15.715 (establishing a similar database administrator structure to administer TV bands).

58 *FNPRM,* App. A, § 96.48.

59 PCAST Report at 7.

dedicating the 3550-3650 MHz band to small cell, low power use "could allow for significant reduction or even elimination of the [Federal] exclusion zones."[60] Notably, PCAST envisioned that a database component of the SAS would allow for the registration of Federal operations and analysis of necessary exclusion zones, in turn enabling the SAS to give or deny permission to secondary access and general authorized access users.[61]

In the *FNPRM*, however, the Commission's proposal has deviated from several key principles of the PCAST report. Specifically, the *FNPRM* proposes that CBSDs comply with the extensive geographic Exclusion Zones first outlined by NTIA in its Fast Track Report.[62] The Commission posits that this step is necessary "to ensure compatibility with federal operations, and that the SAS ensure that CBSDs do not operate within Exclusion Zones."[63] The *FNPRM* also makes no mention of any requirement that Federal incumbents supply to the SAS necessary data to enable dynamic channel assignment.

Several of the Commissioners share AT&T's concern that the exclusion zones proposed by the Commission are too large. As Commissioner Pai has observed, the *FNPRM* "does not incorporate the unrebutted technical evidence showing that the 2010 exclusion zones can be dramatically reduced while still protecting incumbent federal users."[64] By proposing to codify the 2010 exclusion zones, the Commission has jeopardized the success of the 3.5 GHz band by creating a scenario where 60 percent of the U.S. population would be prohibited from using 3.5

---

60 PCAST Report at 51.

61 PCAST Report at 101-102.

62 *FNPRM* at ¶ 38.

63 *Id.*

64 *FNPRM*, Concurring Statement of Commissioner Ajit Pai.

GHz devices.[65] As Commissioner O'Rielly observes, "[d]espite evidence in the record showing that low-power small cell systems will not require such large exclusion zones, there has been no progress in reducing their size, even for this limited purpose."[66] Commissioner Rosenworcel has also stressed that "what we learn from managing exclusion zones in the 3.5 GHz band could yield possibility for commercial services in the 5 GHz band,"[67] underscoring the importance of codifying an appropriate approach to exclusion zones.

Application of NTIA's 2010 exclusion zones to the 3.5 GHz band is inappropriate for two reasons. First, and as PCAST noted, the initial exclusion zones were calculated based on the assumption that the 3.5 GHz band would be auctioned for high-power wide-area use consistent with current commercial wireless business models.[68] As PCAST observed, the size of an exclusion zone would logically vary dramatically depending on the power levels and antenna heights of secondary and tertiary users.[69] What the Commission has proposed for the 3.5 GHz band will involve small cell architecture that will operate at much lower power levels than commercial wireless networks, that are characterized by high base station power and low power mobile devices. Second, the original exclusion zones were premised on a mutual obligation of Federal incumbents and commercial users to protect each other from interference. Here, however, PAL and GAA operations would be operating on a secondary and tertiary basis and would have no protection rights with respect to Federal incumbents.

---

65 *Id.*

66 *FNPRM,* Statement of Commissioner Michael O'Rielly.

67 *FNPRM,* Statement of Commissioner Jessica Rosenworcel.

68 PCAST Report at 51.

69 *Id.* at 75.

AT&T agrees with Commissioner Pai that "the success of the 3.5 GHz band depends on shrinking the proposed exclusion zones."[70] In particular, it is critical that protection zones be revisited based on the morphology of the actual systems to be deployed in the 3.5 GHz band rather than the assumptions made initially by the Federal government. Additionally, there is simply no need for protection zones to encompass protection of commercial systems from Federal operations. As long as the technical parameters of the interfering Federal incumbent systems are made clear to potential commercial wireless licensees, each independent licensee/bidder will be best positioned to balance the risks associated with access to this spectrum – and should not be restricted by Federal concerns about interference to commercial operations.

E. The 3650-3700 MHz Band Should Continue To Be Available for Point-to-Point and Point-to-Multipoint Services

While AT&T commends the Commission for its innovative proposals to allocate the 3.5 GHz band for small cell deployment and spectrum sharing, AT&T is also considering the use of both point-to-point and point-to-multipoint backhaul technologies for small cells in the 3.5 GHz band. AT&T is concerned about the complexity of the new and unprecedented Spectrum Access System ("SAS") licensing framework. How will the SAS coordinate with vendor proprietary systems for both RAN access and backhaul? What is the coordination process for "shifting" the spectral location of the PAL license? If the license is being used for backhaul, how will the SAS coordinate the point-to-point or point-to-multipoint links to ensure that each link(s) has been assigned the proper channel and power level? How will the SAS coordinate proper channel and power level assignment across census tracts if a control node (hub) in a point-to-point or point-

[70] *FNPRM* , Concurring Statement of Commissioner Ajit Pai.

to-multipoint network is located in one census tract and one or multiple remotes (at metrocells) are located in another census tract?

While AT&T supports the inclusion of the 3650-3700 MHz band in this licensing regime, certain technical requirements will need to be adjusted depending on whether this spectrum is incorporated into the 3.5 GHz band. The equipment currently used by operators in the 3650-3700 MHz band is not required to support the core functions that are envisioned to be performed by the SAS. Use of dynamic channel allocation will cause retuning of the point-to-point or point-to-multipoint network which in turn could lead to service interruptions. By changing the operating frequency of a single node, the SAS will trigger a service interruption in backhaul links and small cells that are served by the backhaul links. Changes to the frequency or bandwidth would further degrade network quality.

The current interference avoidance schemes in the 3650-3700 MHz band require the equipment to implement a contention-based protocol to recognize and potentially react, *e.g.*, suspend and/or retune frequency, to other operational base stations to minimize interference. However, contention protocols for equipment operating in the lower 25 MHz of the band, *i.e.*, 3650-3675 MHz, or the restricted band, are only required to recognize similar protocols. How will the SAS systems coordinate operation with the 3.65-3.675 GHz restricted band if the equipment does not have the capability to sense or prevent interference with dissimilar contention technologies operating? Will all restricted band commercial operations cease with the requirement to replace all equipment?

As stated previously, a centralized spectrum manager will not be able to operate such interference coordination features because it will not have the tight latency and time synchronization required to perform such coordination in a point-to-multipoint network using an

LTE physical layer and protocols. Moreover, if a centralized spectrum manager were to semi-dynamically allocate geographically adjacent census blocks to operators using different air interface technologies (LTE vs. non-LTE); such interference coordination/cancellation techniques would not be able to mitigate the interference caused to the LTE network or vice versa. This would likely cause harmful interference and undue degradation of network performance in both adjacent networks.

F. Licensees Will Require Certainty and Transparency With Respect to Technical Issues in the 3.5 GHz Band

The novel nature of the new 3.5 GHz licensing regime presents a number of unique technical issues that must be resolved by the Commission prior to the deployment of service in this band. AT&T believes that the technical decisions made by the Commission must be guided by current technological realities, not by the potential of future capabilities that have not been shown to be feasible. In this regard, AT&T is concerned that compliance with certain of the Commission's technical rule proposals has not been proven to be technically feasible at this time. Meanwhile, compliance with others may prove extremely challenging to the point of being unrealistic. To confidently invest in this spectrum environment, licensees require certainty and transparency with respect to the technical parameters they will be required to maintain. AT&T outlines specific concerns herein.

Geo-Location Requirements. In proposed Section 96.36, the Commission plans to require that CBSDs be able to determine their geographic coordinates to an accuracy of ±50 meters horizontal and ±3 meters vertical.[71] Further, a CBSD must re-establish its position and report changes to its position within 60 seconds to the SAS each time it is activated from a

[71] *FNPRM* ¶ 62.

power-off condition.[72] A CBSD must check its location at least once every 60 seconds while in operation and report to the SAS any location changes exceeding ±50 meters horizontal and ±3 meters elevation within 60 seconds of such location change.[73] AT&T is unaware of any feasible technology to meet the horizontal and vertical accuracy requirements proposed in Section 96.36(a). Indeed, in the Commission's ongoing proceeding on E911 location accuracy, numerous parties highlighted the technical infeasibility of very similar location accuracy requirements.[74] As AT&T observed in that proceeding, a location accuracy Test Bed revealed that only one tested system even occasionally approached the Commission's proposed 50 meter location accuracy standard, and this system will not be widely available in the near term.[75]

The Commission's timing requirements are also problematic. Wireless providers and manufacturers rely upon GPS technologies to provide position fixes, but in the 3.5 GHz band many (if not all) CBSD devices will be located indoors and the device may not be able to reliably detect GPS and provide a location fix in all indoor locations. Even if the device can obtain a GPS location fix, AT&T believes that in many cases this would take longer than the 60 seconds proposed by the FCC. This concern is based on the fact that in real-world data gathered by

---

72 *Id.* ¶ 63.

73 *Id.*

74 *See, e.g.*, Comments of Ericsson to the Commission's Third Further Notice of Proposed Rulemaking, PS Docket No. 07-114, at 2 (May 12, 2014) ("Ericsson Location Accuracy Comments") ("Many of the technologies referenced in this report are still in development – indeed, one other vendor cited in the Notice posited that it would take *more* than three years before the level of accuracy the Commission has proposed would be realized.") (emphasis in original); Comments of CTIA – The Wireless Association®, PS Docket No. 07-114, at 6 (May 12, 2014) ("CTIA Location Accuracy Comments") ("The Test Bed Report also revealed shortfalls. First, no technology achieved the accuracy benchmarks proposed by the Commission in all environments.").

75 Comments of AT&T, PS Docket No. 07-114, at 8-9 (May 12, 2014) ("AT&T Location Accuracy Comments").

consumer product deployments requiring GPS, these GPS location fixes have averaged approximately 5 minutes. In enterprise environments, that could include urban canyons or other difficult locations for GPS functionality, AT&T's experience has shown that GPS location fixes can take even longer than 5 minutes.

AT&T does agree that location information would be important for the SAS to function properly. However, the location accuracy and time to location fix proposals made by the Commission are technically infeasible. AT&T would also like additional clarity on how CBSDs will know that their location has changed. If the Commission's vision is that CBSDs will continually poll GPS to attempt to determine if a device has been moved, that raises additional implementation issues. For mobile CBSDs, the number of consistent GPS location fixes will greatly reduce battery life and, given the amount of time it generally takes to get a location fix, may still not provide the level of accuracy sought by the Commission in any event.

Moreover, as AT&T has suggested that PALs not be subject to dynamic spectrum allocation, PALs would not need this level of location accuracy to be associated with their usage. PALs would instead be able to manage their interference environment without the need for providing specific location information for each CBSD to the SAS and instead would provide their licensed service area that required protection to the SAS. In contrast, GAA devices would require location information to be accurately provided to protect both Incumbent Access and PAL tier licensees.

Whatever geo-location requirements the FCC adopts should be based on currently available technology and not future capabilities that have not been shown to be commercially feasible. And, the existence of these capabilities must be proven in independent, standardized tests, rather than based on mere vendor claims. As with other implementation issues associated

with the SAS, AT&T would suggest a "walk before run" approach to location accuracy and timing. Based on the state of the art location technology in the market today, the proposed FCC rules for location accuracy and timing for location fixes are impractical. Rather than providing a specific rule for geo-location at this time, AT&T would suggest that the FCC require that there be geo-location and reporting, but defer on specifics until the SAS itself is developed and agreed upon by the multistakeholder group AT&T suggests below. By not prescribing unattainable limits for geo-location, the FCC will allow the industry to reach a consensus on the soundest technical approach for location accuracy. At that point, specific rules for geo-location could be adopted (if necessary) or the multistakeholder group can simply develop best practices that will bind the SAS and administrators.

Interoperability. The Commission has proposed that all CBSDs be capable of operating on any frequency from 3550-3700 MHz.[76] As noted above, AT&T supports the inclusion of the 3650-3700 MHz band in the new Part 96 framework. While AT&T believes that interoperability in the 3.5 GHz band can technically be achieved, it does not believe interoperability requirements should be imposed by rule. While no 3GPP band class fully encompasses the 3550-3700 MHz band as described in the *FNPRM*, AT&T believes that a new band class could be introduced and approved. Additionally, AT&T believes that a single duplexer could be deployed to cover the entire 3550-3700 MHz band, given the high frequency. As AT&T has previously noted to the Commission, the pass band for a particular frequency is typically limited to about 4 percent of the center frequency of the spectrum being used.[77] For the 3550-3700 MHz band, the center frequency would be at 3625 MHz. Four percent of 3625 MHz is 145 MHz,

---

[76] *FNPRM* ¶ 64.

[77] Comments of AT&T, GN Docket No. 12-268, Exhibit A, at 8 (January 25, 2013) ("AT&T Incentive Auction Comments").

which is approximately equivalent to the 150 MHz of total spectrum available in the band. From purely a technical perspective, AT&T supports interoperability across the entire band because this will address the Commission's concern that implementing a transitional framework will balkanize the band. An interoperability requirement will also help to establish uniform certification requirements for both the GAA licensees and the PAL equipment. Both these points are important to generate economies of scale and also to make sure that GAA equipment is manufactured to the same standards as the PAL equipment.

Interference Reporting. The Commission's proposed Section 96.36(d) suggests that CBSDs would report to the SAS if they experience interference that exceeds a threshold established by the SAS.[78] To meet this requirement, CBSD devices would need to incorporate the ability to measure and report on their local signal level environment. AT&T believes that such measurement information must be provided rapidly enough to mitigate the interference—a task that will be very difficult for the SAS to manage. Interference reporting is needed to reassure AT&T customer's that spectrum allocation and adjacent licensees changing will not adversely affect the network operations expected. Without rapid, actionable information from the SAS on interference issues, AT&T will not be able to react to the issue in time to manage interference to its PAL and the SAS will not be able to manage the dynamic frequency assignments. The Commission also has not stated over what bandwidth the measurements would be reported. Further, it is not clear how this threshold would be established, whether an individual SAS administrator could establish the threshold, or whether multiple SAS Administrators may be permitted to establish different thresholds. At a minimum, the SAS must

78 *FNPRM* ¶ 66.

employ set algorithms so that consistent results are provided and all stakeholders agree on the underlying assumptions.

Even if those issues are resolved, other concerns and complications remain. For example, it would be highly problematic if, based on interference reporting, spectrum resources are taken away from PALs during busy hours of the day. Further, FDD and TDD services will require different interference resolution algorithms. These issues are not contemplated in the Commission's discussion of the proposed rule, and AT&T is concerned that the Commission has over-simplified matters of interference reporting and resolution.

Conducted and Emitted Power Limits. AT&T generally supports the proposed conducted and emitted power limits in the new Section 96.38.[79] However, AT&T requests clarification on the conducted and emitted power limits presented in the table in proposed Section 96.38. The proposed rule has end user devices limited to 23 dBm/10 megahertz for the "maximum EIRP." In addition, AT&T seeks clarification that this value is a maximum average power value. The same question is true for each of the values provided in the table in proposed Section 96.38 – *i.e.*, the rule should specify whether the values to be measured as peak or average. Indeed, if the values are to be peak values, the FCC should provide detail on how licensees should measure such values. For example, one of the most repeatable ways to measure peak power is to use an instrument capable of generating a complementary cumulative distribution function ("CCDF"), which reports power peaks as a statistical likelihood of occurrence at a certain power level above the average power. AT&T suggests that CCDF would be an appropriate mechanism to measure peak power, if that is what the rule is intended to prescribe.

---

79 *Id.* ¶¶ 70-78.

However, there are a couple of clarifications that the Commission should provide to guide parties for these power limits. First, the LTE and LTE-Advanced standards make available the use of Multiple-Input Multiple-Output ("MIMO") antenna schemes.[80] MIMO allows for multiple transmitting antennas to be utilized within an LTE device – leading to the question on how the Commission envisions the power limits to apply to MIMO configurations. AT&T believes that each branch of the MIMO configuration should be permitted to operate at the maximum power limits proposed in Section 96.38. If this conclusion is inaccurate, the FCC should make clear what it believes the power limits should be for MIMO deployment.

Next, for point-to-multipoint and point-to-point services in the 3650-3700 MHz band, the power limits should be modified to be consistent with the current requirements for the band. The current power limits for the 3650-3700 MHz band specify that the peak EIRP power density shall not exceed 1W (30dBm)/MHz. For a 10 MHz channel bandwidth, the EIRP is 10W or 40dBm. The existing operators have designed their networks for coverage, link budget, throughput, latency, and QoS based on equipment that supports these requirements. To apply the proposed power level limits of 30 dBm for a 10MHz channel bandwidth may cause existing 3650-3700 MHz commercial operations to cease or significantly increase network capital and operational costs associated with deploying new equipment or sites because of the reduced link budget. Therefore, AT&T supports peak transmit power limits for CBSDs in the 3650-3700 MHz band that are consistent with the existing rules, *i.e.*, peak 1W (30dBm)/MHz PSD to enable commercially viable backhaul applications in the band.

---

[80] *See e.g.*, 4G Americas, *MIMO and Smart Antennas for Mobile Broadband Systems, available at* http://www.4gamericas.org/UserFiles/file/White%20Papers/MIMO%20and%20Smart%20Antennas_July%202013_FINAL.pdf (last visited July 14, 2014).

Received Signal Strength Limits. The FCC has proposed in new Section 96.38(c) that CBSD transmissions shall be managed such that the median signal strength at any location on the boundary of a co-channel PAL shall not exceed -80 dBm as measured by a 0 dBi isotropic antenna in 10 megahertz unless the affected licensees or incumbents agree to a different field strength and communicate that to the SAS.[81] AT&T notes that it will be challenging for the SAS to measure, calculate, and enforce such limits on co-channel boundaries as suggested by the Commission, especially when the license area is small and location accuracy technologies are not sufficiently developed.[82]

Moreover, the proposed -80 dBm limit is higher than what AT&T would recommend for a signal strength limit at the service area boundary. Instead, AT&T would suggest that the Commission refer to the 3GPP standards for setting the boundary limit. 3GPP standards for band classes 42 and 43 (which include the 3550-3700 MHz spectrum bands) have set a reference sensitivity limit at -96 dBm in 10 MHz channel bandwidth.[83] AT&T believes adoption of this more conservative receive signal strength limit will ensure that PAL and GAA users will not create excessive interference at the boundaries of their service areas. AT&T does agree with the Commission that this limit can be negotiated to be higher if coordinated among all affected parties.

Out of Band Emission Limits. The Commission has made several Out of Band Emission ("OOBE") proposals in the *FNPRM*. First, for PAL and GAA operations, it proposes to apply its long-standing 43 + 10 log (P) dB limit to all emissions outside of channel assignments and

---

81 *FNPRM* ¶ 79.

82 *Id.*

83 *See* 3GPP TS 36.101 v12.3.0, *available at* http://www.3gpp.org/DynaReport/36101.htm (last visited July 8, 2014).

frequency assignments made by the SAS.[84] The Commission further proposes that for CBSD emissions above 3680 MHz or below 3520 MHz, a more stringent limit should be applied.[85] Specifically, the power of any emissions at these frequencies shall be attenuated below the transmitter power in watts by at least 70 + 10 log (P) dB.[86]

AT&T supports the proposal to adopt the standard 43 +10 log (P) OOBE limit for the 3.5 GHz band. Adoption of this requirement is consistent with the OOBE limits placed on other CMRS spectrum bands to protect against harmful interference to adjacent bands. AT&T also supports the tighter 70 + 10 log (P) limits at 30 megahertz outside the licensed spectrum bands. While this requirement is challenging, most equipment vendors should be able to meet these lower emission requirements because, as the Commission notes, there are similar requirements in other bands. However, AT&T would note that the OOBE limits contained in proposed Section 96.38(d) will need to be modified should the 3650-3700 MHz band be added to the available spectrum. 96.36(d)(1) discusses spectrum from 3550-3650 MHz (which should be extended to 3550-3700 MHz) and 96.36(2) has OOBE emissions limitations at "above 3680 MHz" which should be modified to "above 3730 MHz" if the 3650-3700 MHz band is added to the Citizens Broadband Service.

G. Assumptions Associated With the SAS Should be Developed Through a Multi-Stakeholder Group Process

The 3.5 GHz band will be home to an unprecedented licensing environment that will require careful consideration of issues not present in other bands. Once deployed, the SAS will need to be a highly sophisticated system that manages the numerous complexities in the band

---

84 *FNPRM* ¶ 81.

85 *Id.* ¶ 83.

86 *Id.*

and be responsible for maintaining an interference-free environment consisting of diverse licensees. This is no small task. AT&T submits that the Commission can best develop the SAS by chartering a multi-stakeholder group to address issues such as dynamic channel allocation between GAA users, neighbor management, intermodulation, and interference resolution.

The concept of a multi-stakeholder group has substantial support. Indeed, the Commission's Technological Advisory Council ("TAC") recommended the formation of a multi-stakeholder group to investigate various interference issues using the 3.5 GHz band as a pilot band.[87] The record in this proceeding also demonstrates strong support for the formation of a multi-stakeholder group. The Wireless Innovation Forum stated its belief that "the FCC will best be served" by adopting a process that will "enable stakeholders to work together to form tightly focused working groups to evaluate all current and emerging technical issues."[88] The Wireless Innovation Forum added that "[b]y enabling multi-stakeholder groups to participate in the process, the FCC can capture a diversity of opinions gathered and provided from different perspectives on technology, services and business models. This ensures recommendations from those multi-stakeholder groups will be responsive to the FCC rule making process for complex multiuse spectrum issues."[89] Similarly, as the Consumer Electronics Association observed,

---

87 FCC Technological Advisory Council, *Interference Limits Policy and Harm Claim Thresholds: An Introduction* at 3 (Mar. 5, 2014), *available at* http://transition.fcc.gov/oet/tac/tacdocs/reports/TACInterferenceLimitsIntrov1.0.pdf.

88 Comments of the Wireless Innovation Forum, GN Docket No. 12-354, at 5-6 (Dec. 5, 2013) ("WIF December 2013 Comments").

89 *Id.* at 6.

convening such a multi-stakeholder group will help "ensure that standards are driven by consensus, technological concerns, and industry expertise."[90]

Like other participants in this proceeding, AT&T supports and encourages industry action to charter a technical group of stakeholders to develop industry coordination agreements and protocols, including technical options and methods for managing spectrum access for the 3.5 GHz band. By assembling a diverse group of viewpoints, this effort will provide assurance to future 3.5 GHz licensees at all levels that the SAS will be administered in a manner that promotes productive use of spectrum while mitigating interference between diverse services. Such expertise is particularly important in an environment such as the 3.5 GHz band, which will be home to a diverse group of licensees providing innovative services of several types.

There are several issues the multi-stakeholder group can and should study. These include requirements for the SAS certification, cell configuration and setup, neighbor management, intermodulation and harmonic interference, interference reporting, interference resolution, geo-location requirements and the time intervals for frequency allocation. AT&T addresses each of these matters that should be studied by the multi-stakeholder group in detail below.

SAS Certification. AT&T would recommend that the multi-stakeholder group be tasked with developing requirements for the certification of the SAS itself. The SAS will need to manage interference control and resource management to deliver the same level of spectral efficiency and latency that is expected from current and future LTE networks. AT&T believes that such a rubric is necessary to provide incentives for wireless operators to utilize the 3.5 GHz spectrum and help to build the new ecosystem. Based on experiences gained through the development and deployment of mobile broadband networks, the multi-stakeholder group should

[90] Comments of the Consumer Electronics Association, GN Docket No. 12-354, at 4-5 (Dec. 5, 2013) ("CEA December 2013 Comments").

be well positioned to provide an overall framework for the SAS to be certified as achieving the spectral efficiencies metrics expected for small cell network architecture.

Cell Configuration and Setup. As noted above, AT&T opposes the use of dynamic channel allocation for PALs. However, GAA must be accomplished through dynamic channel allocation, which can lead to a series of issues associated with overall network management and interference planning. Use of dynamic channel allocation will cause retuning of the small cell network which in turn could lead to service interruptions. By changing the operating frequency of a single small cell, the SAS will not only trigger a service interruption in its service area but will also impact the service of surrounding small cells. Changes to the frequency and/or channel lineup would necessarily lead to changes in the target frequency, neighbor frequency list, handover trigger, and threshold change, among other parameters. If these issues are not carefully managed, dropped calls or other impacts to the user experience would occur, degrading network quality. By studying this issue, the multi-stakeholder group could provide recommendations to SAS administrators on potential techniques for dynamic channel allocation.

Neighbor Management. Once established, the SAS will not only be required to manage frequency sharing among users in the same market, but it also will need to manage frequency assignments between neighboring parties. Given the small license areas involved, the neighbor coordination issues will be numerous. It is essential that the SAS manage neighboring parties' assignments to ensure a high quality user experience. The same effects as are present above for cell configuration and setup will have a ripple effect on neighboring markets, especially if markets are to be as small as census tracts.

Intermodulation and Harmonic Interference. The SAS will also need to ensure that the 3.5 GHz frequency assignments it makes do not impose intermodulation products into

frequencies that need to work with 3.5 GHz spectrum. Existing wireless operators are well aware of the operating environment and the associated intermodulation products that can be expected. The SAS will need to take this into account in some fashion as it is determining the best frequency resources to provide to GAA users to avoid this issue. AT&T believes its proposal to allow PALs the ability to define their particular frequency usage (as opposed to receiving dynamically assigned spectrum) will greatly alleviate the concerns associated with intermodulation and harmonic interference, especially if this band is used for supplemental downlink and is carrier aggregated with a primary band.

Interference Resolution. Similarly, AT&T submits that the use of a SAS raises practical questions that could be resolved through the multi-stakeholder process. The Commission has proposed that the SAS be charged with interference management with respect to the three tiers of service.[91] However, it is possible that multiple – or even all – CBSDs in a market experience and report interference at the same time. The SAS will need to decide what to do if a device cannot operate as expected and there is no other available frequency resource in the market. Before the SAS becomes operational, procedures for such a situation must be developed, and should be created with the input of affected stakeholders.

Geo-location and Reporting Requirements. As noted above, promulgation of specific location accuracy and timing associated with location fixes is premature at this time. Instead, AT&T would suggest that this issue be deferred to the multi-stakeholder group to develop best practices associated with geo-location that are based upon commercially available technology.

Time Intervals for Frequency Allocation. Another practical consideration is one of timing. The Commission has proposed that the SAS make periodic determinations of available

---

91 *FNPRM* ¶ 6.

frequencies and assign them to CBSDs.[92] However, it is unclear whether there will be a minimum time interval for dynamic frequency allocation, or how frequently the SAS will poll the interference environment. The SAS will need to gather data both on the spectrum resources available and the performance of existing PAL and GAA operations. AT&T submits that industry experts should collaborate to determine an interval that both is realistic and ensures the highest possible quality of service for users.

In short, while the Commission has outlined several responsibilities for the SAS, there are many key issues that have been left unanswered by the *FNPRM*. AT&T joins those commenters in this proceeding who submit that a multi-stakeholder forum is the best way to identify, examine, and resolve these unanswered questions, and that this group should convene and provide recommendations prior to SAS Administrators' selection and commencement of operations.

V. CONCLUSION

Permitting small cell deployment and spectrum sharing in the 3.5 GHz band can be used as a partial means to address the nation's impending spectrum crisis. Although the Commission has made important strides in crafting rules to bring the 3.5 GHz band to market, there are still many questions left unanswered and much work left to be done to ensure that this spectrum is put to its best and most efficient use.

To ensure that the smooth and prompt roll-out of service, AT&T has proposed some modifications to the Commission's proposed framework. As an initial matter, to encourage robust deployment and investment, AT&T recommends that the PALs be given specific frequency assignments. AT&T also supports establishing a transitional phase to allow

---

92 *Id.* ¶ 95.

immediate access to the 3.5 GHz band while the SAS concept is tested and refined. Further, AT&T urges the Commission to reconsider its position that PALs should be non-renewable with no renewal expectancy. In a similar vein, AT&T suggests that the Commission provide greater clarity with respect to the proposed auction procedures, and the protections to be afforded to information collected by the SAS. Finally, AT&T highlights some of the critical technical issues that, if left unresolved, will present challenges to deployment in the 3.5 GHz band. AT&T believes that a multi-stakeholder forum could play an essential role in resolving the various uncertainties surrounding the 3.5 GHz band, and it stands prepared to assist with this effort.

Respectfully submitted,

By: /s/ William L. Roughton, Jr.

William L. Roughton, Jr.
Michael Goggin
Gary L. Phillips
Lori A. Fink
1120 20th Street, N.W.
Suite 1000
Washington, DC 20036
(202) 457-2040
Counsel for AT&T Services, Inc.

Dated: July 14, 2014